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Keirestsu Centrality - Profits and Profit Stability: A Power Dependence Perspective

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Abstract

Prior studies compare *keiretsu* member firm and independent firm performance. Here, we use historical and power dependence perspectives to theorize that the Japanese *keiretsu* system primarily benefits the most central firms. We test this by examining the performance of two types of *keiretsu* firms (central firms and other member firms) within two types of *keiretsu* (horizontal and vertical). We hypothesize and find that: (1) central vertical *keiretsu* firms are more profitable than central horizontal *keiretsu* firms; (2) central horizontal *keiretsu* firms have greater profit stability than central vertical *keiretsu* firms; (3) central vertical *keiretsu* firms are more profitable than non-central vertical *keiretsu* firms; and (4) central horizontal *keiretsu* firms have greater profit stability than non-central horizontal *keiretsu* firms. Implications for managers and future research directions are discussed.

Keywords: Keiretsu, dependence, vertical, horizontal, profitability, central firm

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1. Introduction

Do some firms in a Japanese *keiretsu* systemically benefit more than others? The Japanese *keiretsu* system has attracted strategy (Geringer et al., 2000), management (Bernotas, 2005; McGuire and Dow, 2002), finance (Weinstein and Yafeh, 1998) and sociology scholarship (Lincoln et al., 1996), typically emphasizing the unique benefits *keiretsu* affiliation offers member firms rather than possible differential performance among different types of member firms. Prior studies note that *keiretsu* affiliated firms typically have greater profit stability than *non-keiretsu* firms (Lincoln et al., 1996; McGuire and Dow, 2003) but fail to compare performance among different types of *keiretsu* member firms.

Kim et al. (2004) were the first to use power dependence theory to predict performance differences between central and non-central members. They compared horizontal *keiretsu* member performance to non-*keiretsu* firms. They found systematic differences in sales growth between central and non-central members under conditions of product and international diversification and also found support for profitability differences for central and non-central firms under conditions of international diversification but not under conditions of product diversification. Findings with respect to product diversification and profitability indicated that both central and non-central firms outperformed non-*keiretsu* firms.

Due to their methodology, Kim et al. (2004) was unable to identify performance differences between central and non-central firms, particularly when both performed similarly relative to non-*keiretsu* firms leaving open the question of relative performance differences.

Such differences may be important because variables like profit stability have theoretical importance and served as the dependent variable of interest in prior studies (Lawrence and Saxonhouse, 1991; Lincoln et al., 1996; McGuire and Dow, 2003).

Here we expand upon the initial work of Kim et al. (2004) in three ways. First, Kim et al. (2004) only examined horizontal *keiretsu*. In contrast we examine both horizontal and vertical *keiretsu*. Second, we use differing historical experiences to explain why horizontal *keiretsu* central firms emphasize profit stability while vertical *keiretsu* central firms emphasize profitability. This undergirds the theoretical bases for hypotheses one and two. Third, Kim et al. (2004) compared central and non-central firms' performance to that of independent firms, an indirect method of examining the relative performance of *keiretsu* member type. In contrast we directly compare central and non-central firm performance differences for both types of *keiretsu*. Using power dependency theory, we hypothesize performance differences between central and non-central firms regarding profit stability for horizontal *keiretsu* and profitability for vertical *keiretsu*.

Thus, our study advances what we know about the *keiretsu* in three distinct ways. We extend analyses to include: (1) both vertical and horizontal *keiretsu* (2) theorizing and empirically testing the notion that for historical reasons performance goals for vertical and horizontal *keiretsu* central firms differ (H1 and H2); and (3) theorizing and empirically showing that power dependency theory predicts performance differences between central and non-central firms for both types of *keiretsu* (H3 and H4). In doing so we attempt to answer three questions: Do central firms benefit from being central to a Japanese *keiretsu*? Are central firms the primary beneficiary of a Japanese *keiretsu*? And do horizontal and vertical central firms benefit differently?

2. Literature and theory development

Horizontal *keiretsu* are characterized by interlocking board memberships, strong, rarely traded reciprocal equity positions and lending ties with a central financial firm (McGuire and Dow, 2009). These relationships provide horizontal members advantages including stable financing, insulating firms from market pressures (Sheard, 1994) and reciprocal monitoring which can reduce risk for transaction partners (Khanna and Yafeh, 2005).

Studies examining horizontal *keiretsu* performance find evidence of lower risk and income smoothing across the group (Gedajlovic and Shapiro (2002) and McGuire and Dow (2003)). Wang et al. (2005) find horizontal *keiretsu* affiliation significant for Japanese owned foreign subsidiaries remaining profitable or improving profitability during the Asian economic crisis of 1997-1998. They conclude that horizontal *keiretsu* affiliation can help shelter resources and further adaptation in radically changed environments.

Studies point to advantages for central firms in horizontal *keiretsu.* Kim et al. (2004) found differences in sales growth between central and non-central firms. Weinstein and Yafeh (1998) found that member firms relying on central firm financing have higher costs of capital than independent firms. Bernotas (2005) suggests that central firm banks, stress their 'creditor' role (emphasizing lower risk strategies and asset protection) rather than their 'shareholder' role (emphasizing profitability), finding that member firms with strong central firm lending relationships don't maximize profits. Evidence suggests that Horizontal *keiretsu* benefits do not distribute uniformly across members.

Vertical *keiretsu* are characterized by a central manufacturing firm, key suppliers and affiliated suppliers where material equity holdings run from the central manufacturer and key

suppliers to affiliated suppliers (McGuire and Dow, 2009). Benefits of vertical *keiretsu* include: fewer suppliers, lowered transactions costs, increased coordination and innovation, lower opportunism, easier international entry and more stable production (McGuire and Dow, 2009; Tabeta and Rahman, 1999). Dyer and Ouchi (1993) estimated that in 1986 the limited number of suppliers used by Toyota due to its *keiretsu* centrality gave it a 10% cost advantage against General Motors.

Equity ownership in affiliated suppliers is approximately three times that of independent suppliers (Tabeta and Rahman, 1999). Such ownership suggests a control orientation (Lincoln et al., 1996; McGuire and Dow, 2009; Tabeta and Rahman, 1999) that benefits central firms. For example, Peng et al. (2001) suggest that innovation in a vertical *keiretsu* is driven by the needs of the central manufacturer. Lincoln and Gerlach (2004: 29–30) wonder if vertical *keiretsu* "generate genuine efficiencies or whether the advantages they afford to parent firms… come at the expense of the profits, growth rates, and wages of suppliers." Dow and McGuire (2009) compare what they call strongly and weakly affiliated *keiretsu* members to independent firms and find evidence that strongly affiliated members benefit at the expense of weakly affiliated members.

When resources are exchanged, dependencies can be created, representing power imbalances. Resources include assets, attributes, and conditions within a relationship that generate and represent organizational dependence, indebtedness, or allegiance to each other (Berthon, et al., 2003). Through the exchange of such resources power dependent relationships are formed where dependent organizations are subject to influence attempts by more powerful organizations that control critical resources or contingencies (Berthon et al., 2003).

Unequal distribution of benefits can be created through the influence of power dependence. Yamaguchi (1996) suggests that actors with greater power attempt to maximize their own benefits. Molm et al. (1999) suggests that power imbalances create inequality in exchanging benefits; more powerful actors receive greater benefits. When power-dependence relationships exist, more powerful actors may influence the decision making of less powerful actors and/or receive greater benefits. In our hypotheses we propose that benefits arising from horizontal and vertical *keiretsu* systems do not accrue equally across all members; central firms disproportionately achieve their aims at the expense of other member firms.

3. Hypotheses

3.1 Horizontal keiretsu central firms versus vertical keiretsu central firms

Business groups commonly occur in weak/uncertain institutional environments (Granovetter, 2005), like the environment which spawned the prewar *zaibatsu*. Affiliation with a business group increases stability for firms by internalizing transactions and reducing risk, particularly compared to unaffiliated firms when environments lack strong, stable institutions (Carney et al, 2011). Given weak, uncertain institutional environments, firm goals (profit stability, survival or profitability) are more achievable within the more predictable, internal business group environment. Firms commonly subordinate themselves, creating power dependency relationships, in exchange for entry into the predictable business group environment, improving their chances of surviving and achieving their objectives.

Horizontal *keiretsu* originated from the bank-affiliated *zaibatsu* but was tempered by economic turbulence of the 1920's that led to extensive *zaibatsu* failure (Morck and Nakamura, 2005). The *zaibatsu* that survived, such as Mitsui and Sumitomo, did so because the banks

they owned held diversified risks instead of solely being a funding source and weren't overly exposed to the outcomes associated with a single firm or industry. This reinforced stability concerns, that eventually lead to the creation of what becomes horizontal *keiretsu* business groups.

Initially in the Post WWII occupation of Japan, America sought to dissolve the *zaibatsu* through banking reform and regulatory initiatives. The U.S. later retreated from this position due to the deepening Cold War and the increasing influence of the Soviet Union in the Pacific. This retreat allowed former *zaibatsu* owners to take advantage of the weak institutional environment and reconstitute portions of their former organizations as horizontal *keiretsu* utilizing the banking laws. Post WW II Japanese banks were allowed to own equity in non-financial firms (Morck and Nakamura, 2005) giving them the potential ability to create monopolistic positions through pyramid structures. Japan's history of economic turbulence and concentration-induced failure sensitized financial firms to these risks, orienting them toward safety as a primary goal; creating a preference for stability in profits, particularly for the financial firms central to the horizontal *keiretsu* (Morck & Nakamura, 2005).

The powerful horizontal *keiretsu* central firms imposed profit stability goals on member firms. Using the lure of increased chances of survival (capital access, managerial expertise), central firms induced many member firms in unrelated industries to enter into power dependency (equity, debt and management interlock) relationships (Bernotas, 2005; McGuire and Dow, 2003; Prowse, 1992). Horizontal *keiretsu* membership is commonly limited by 'wan-setto shugi' or the 'one-set' principle; only one large firm from each major economic sector was allowed (Lincoln and Gerlach, 2004), fostering stability. Also intra-group trade was limited (Lincoln & Shimotani 2010). Power dependency facilitated membership and transaction

restrictions effectively resulted in horizontal *keiretsu* having diversified portfolios, limiting the negative economic impact of any single firm on other firms or central firms.

Vertical *keiretsu* have an origin unrelated to the institutional setting which formed the horizontal *zaibatsu*. The Meiji Restoration created conditions for a rapid industrialization of Japan (Morck and Nakamura, 2005) which led to the formation of industrial focused *zaibatsu* by skilled engineers, such as Toshiba and Hitachi, to take advantage of scale and scope economies (Morck and Nakamura, 2005). The 1930's Japanese military used these *zaibatsu* as command and control structures focused on industrial efficiency but post WWII Soviet aggression pivoted the emphasis of U.S. policy from rebuilding industrial Japan toward defending the region. The industrial focused *zaibatsu* were critical to this effort (Morck and Nakamura, 2005).

Vertical *keiretsu* are the modern descendants of these industrial-based *zaibatsu*. The U.S. reconstruction of industrial Japan redirected *zaibatsu* toward American corporate governance with an emphasis on profits and growth (Morck and Nakamura, 2005). Under U.S. occupation, the Japanese wartime goal of *zaibatsu* industrial efficiency became, with Anglo-American "guidance", directed toward the twin vertical *keiretsu* goals of profits and growth.

Vertical *keiretsu* are concerned with economic efficiency. Similar to horizontal *keiretsu*, membership is used as a central mechanism to foster these goals. Using the lure of growth and profitability [long term contracts, technical efficiencies (Tabeta and Rahman, 1999; Lai, 1999)] member firms enter into power dependency relationships [relationship-specific investments, management interlocks (Sambharya and Banerji, 2006)] fostering the more powerful central firm's profitability goal. Large manufacturing central firms limit vertical *keiretsu* membership to industry-specific, related sectors, emphasizing industry relevant profitability factors such as

scale, supplier integration, innovation and just in time inventory (Lincoln and Shimotani, 2010).

In order to take advantage of opportunities offered by the central manufacturer other members subordinate their autonomy, often through relationship-specific investments, creating power dependency. Such vertical integration fosters industry level efficiencies, enhancing profit in a manner that is similar to related diversifiers (Markides and Williamson, 1994); it also exposes vertical *keiretsu* to greater industry-specific volatility than horizontal *keiretsu.*

Given the above reasoning, we theorize that central firms in horizontal *keiretsu* and vertical *keiretsu* use power dependency relationships with member firms to facilitate two distinct goals. For central horizontal *keiretsu* members the goal is profit stability while profitability is the goal for central vertical *keiretsu* manufacturers.

Central firms in horizontal *keiretsu* use the lure of increased stability and increased chances of survival to induce firms in unrelated industries to enter into power dependency relationships with the central firm. We hypothesize that from these diversified relationships central horizontal *keiretsu* firms are able to achieve greater profit stability than the central vertical *keiretsu* firms.

Large central manufacturers limit vertical *keiretsu* to specific industry sectors, emphasizing industry-relevant success factors. To take advantage of opportunities presented by the central manufacturer, smaller industry-specific firms freely enter into power dependency relationships, allowing the manufacturer to pursue its goal of profits.

We hypothesize that due to these effects, central manufacturers in vertical *keiretsu* have higher levels of profits than the central firms found in horizontal *keiretsu*. While central firms

in horizontal *keiretsu* have greater profit stability than central manufacturers in vertical *keiretsu*.

H1 - Horizontal *keiretsu* central firms typically have greater profit stability than vertical *keiretsu* central firms.

H2 - Vertical *keiretsu* central firms typically have greater profitability than horizontal *keiretsu* central firms.

3.2 Horizontal keiretsu central firms versus non-central firms

Central firms draw upon a wide range of industries and member firms in constructing horizontal *keiretsu.* By diversifying, the central firm's minimizes financial risk, helping to generate more stable profits (Lawrence and Saxonhouse, 1991).

Bernotas (2005) found that in Japan the largest debt holder typically controls 25% of a firm's debt and 5% of the firm's equity, ownership levels significantly in excess of U.S. levels. The central firm's position within the *horizontal keiretsu* allows it to act as an agent for multiple cross shareholdings held by other *keiretsu* members, allowing it to control a much larger equity position than a 5% equity position suggests (Bernotas, 2005).

This dual role as critical lender and important shareholder creates opportunities to create power dependence relationships (Bernotas, 2005; McGuire and Dow, 2003). As both major lender and significant equity holder, the central firm is able to obtain transparent information about member firms (McGuire and Dow, 2003) and to influence the actions of management (Weinstein and Yafeh, 1998), putting the central firm in a position to enhance its goals, even at the expense of non-central firms. Central firms stress their 'creditor' role (emphasizing lower

risk strategies and asset protection) rather than their 'shareholder' role (emphasizing profitability); consequentially member firms with strong central firm lending relationships don't maximize profits (Bernotas 2005).

Information access and influence benefit central firms in many ways. Transparent information allows horizontal *keiretsu* central firms to make lower risk loans by identifying risk issues that might not be revealed in standard underwriting processes and also can enable high level monitoring (Bernotas, 2005) by allowing central firms to identify managerial high risk actions. Horizontal *keiretsu* structures enable central firms to mobilize their cross-shareholdings to enact collective action (Aoki et al 1994) including the censure and potential replacement of top management (Sheard, 1994) and also allow central firms to identify and potentially intervene in troubled situations earlier than normal loan covenants would.

Central firm actions facilitating collective action are well documented. For instance, scholarship identified lower bankruptcy risks for horizontal *keiretsu* members compared to independent firms (Suzuki and Wright 1985). Central firm influence has been linked to member firms sacrificing short-term profitability to repay long-term debt (Bernotas, 2005) or to making less risky investment decisions (Weinstein and Yafeh, 1998). Central firms may influence transactions to benefit weaker portfolio members at the expense of stronger portfolio members, creating profit redistribution (e.g., Lincoln et al., 1996) but benefiting central firm stability. Each example illustrates power dependency relationships between central firms and other member firms.

In summary, the horizontal *keiretsu* central firm's power is derived from its unique position as important lender and equity holder, granting it monitoring and influence capabilities, directing member firms toward actions resulting in greater profit stability for

central firms and less profit stability for member firms. Based on this discussion, we hypothesize that in horizontal *keiretsu* central firms have greater profit stability than other member firms.

H3. Horizontal *keiretsu* central firms typically have more stable profits (less profit risk) than less central horizontal *keiretsu* member firms.

3.3 Vertical keiretsu central firms versus member firms

A *vertical keiretsu* is an integrated value chain (Dyer, 1996) composed of one large, central manufacturer and many smaller firms with clearly defined roles (Lai, 1999; Lawrence and Saxonhouse, 1991). Smaller member firms are typically suppliers or distributors (Lai, 1999) that invest in transaction specific assets that benefit the central manufacturer (Sambharya and Banerji, 2006). In turn, the large, central manufacturer provides technological efficiencies, financial resources, and long-term business contracts (Das and Teng, 2002) to member firms.

Past vertical *keiretsu* scholarship hasn't focused on the central firm; but emphasized the positive effect of the *keiretsu* on collective performance. For example, McGuire & Dow (2009, p338) summarize the literature noting many group level effects including how "relational capital and close ties with suppliers may lower transaction costs, encourage coordination and communication and engender a long-term perspective which limits opportunism." The current study is the first to examine advantages that power dependency gives to central manufacturing firms in vertical *keiretsu.*

Providing member firms with key resources in exchange for transaction specific assets, allows the central manufacturer to gain power over other vertical *keiretsu* members. For instance, in the Japanese automobile industry, the automaker (central firm) can offer substantial managerial, technical and financial resources to member firm suppliers. In exchange the

automaker influences member firms' asset specific investment decisions thereby dominating the *keiretsu* (Sambharya and Banerji, 2006). Transactions occurring between automaker and member firm suppliers make the automaker central to the vertical *keiretsu* (Sambharya and Banerji, 2006), reinforcing its dominant position in *keiretsu* power dependence relationships (Pfeffer, 1981).

Central manufacturers typically have several member firm supplier sources for each component they purchase (McMillan, 1990), creating internal competition between the member firms resulting in price competition and allowing central manufacturers to purchase products or services at lower prices (Sambharya and Banerji, 2006). Thus, central manufacturers' power over smaller suppliers in a *vertical keiretsu,* allow it to shift costs to group members. Lower prices increase profit margins for central manufacturers while reducing profitability for group members. Based on the above discussion, we hypothesize that due to power dependence, vertical *keiretsu* central firms typically have greater profits than non-central member firms.

H4 Vertical *keiretsu* central firms typically are more profitable than less central vertical *keiretsu* member firms.

4. Method

4.1. Sample

We created a sample of *keiretsu* firms using COMPUSTAT Global and Dodwell's *Industrial Groupings in Japan* (IGJ). Sample firms needed to be classified as *keiretsu* members in IGJ and be publicly listed on the Tokyo Stock Exchange (TSE). The time frame

chosen is the "post-bubble economy" Japan, 1999-2007; we chose the most recent time frame available (1999-2007), to reflect the current state of Japanese *keiretsu.*

Following previous *keiretsu* studies (Kim *et al*., 2004; McGuire and Dow, 2003), IGJ (Dodwell-IGJ, 1996/7) is used to identify *keiretsu* affiliations. Firms affiliated with one of the eight bank-centered groups (Mitsubishi, Mitsui, Sumitomo, Fuji, Dai-Ichi Kango , Sanwa, Tokai, and IBJ) are classified as horizontal firms. Firms affiliated with one of the 34 "independent" vertical groupings listed in IGJ are identified as vertical firms (Dow et al., 2011). To test Hypotheses 3 and 4, we used IGJ's classification of four stars firms to identify the most central *keiretsu* firms. The final sample contained 417 *keiretsu* members (221 horizontal *keiretsu* members and 196 vertical *keiretsu* members) including 153 central *keiretsu* firms (118 horizontal central *keiretsu* firms and 35 vertical central *keiretsu* firms).

4.2. Dependent variables

We used *Return on Assets* (*ROA*) (Kim et al., 2004) to measure *profitability.* We calculated ROA_i as annual income in year *i* divided by total assets in year *i*. *Profit stability* was measured as the standard deviation of ROA_i from 1999 to Year *i* (Palich et al., 2000) with higher standard deviations for ROA_i, representing less stable profits. This operationalization of profit stability may be sensitive to the number of years within the panel window. In order to examine this issue, we re-examined the model using a cross sectional design which standardized the calculation of the profit stability measure. The cross sectional model supported the findings of the panel model reported here.

4.3. Control variables

Three control variables, *firm size, financial structure* and *industry* past research identified related to firm performance and profit stability (Kim et al. (2004), McGuire and Dow (2003) and Spanos et al. (2004)) were used. We measured *firm size*, by the total number of firm employees (Baum and Wally, 2003; Spanos et al., 2004), *financial structure* as the ratio of liability to equity (Kim et al., 2004). Eight industries (construction, electronic equipment, chemical, machines, transportation, transportation equipment, rubber and mining) classified by SIC 2-digit code were used to control for industry-specific influences (Dess et al., 1990; Geringer et al., 2000; McGuire and Dow, 2003).

4.4 Method

Because our data is time series and the level of analysis is mixed (firms nested within groups), a mixed model, which takes into account nesting effects, is appropriate for testing the relationships in question (Hitt et al., 2007). In a basic multilevel regression model, there are two levels: individual firms (level 1) are nested within groups (level 2). Longitudinal design can also be approached as another type of nested structure, with measurements occasions (level 1) nested within individual firms (level 2). Unlike the basic multilevel design, the current research design has 3 levels: time-series performance measurements (level 1) are nested within individual *keiretsu* firms (level 2) which are associated with particular *keiretsu* groups (level 3).

At level 1 (within firms) $y_{tij} = \pi_{0ij} + \varepsilon_{tij}$ where y_{tij} is the ROA for firm i in group j measured in year t. The intercept is π_{0ij} and ε_{tij} is the error term. We used auto regressive covariance structure as the level 1 covariance structure. Since we have good reasons to believe that firm-level ROA in year *t* is very likely correlated with ROA in another year, the subject is not independent. Since π_{0ij} is likely different across the firms, π_{0ij} is the function of other firm-

level variables, all the control variables (industry dummy, firm size, firm age, financial structure) and the independent variables. Thus, at level 2 (between firms)

$$p_{0ij} = b_{00j} + b_{01j}(industry) + b_{02j}(age) + b_{03j}(size) + b_{04j}(financialstructure) + b_{05j}(IV) + g_{0ij}$$

where β_{00j} is the intercept, γ_{0ij} is the error term for the between firms model and;

β_{01j} represents within group j, the influence of industry on ROA.
β_{02j} represents within group j, the influence of age on ROA,
β_{03j} represents within group j, the influence of size on ROA.
β_{04j} represents within group j, the influence of financial structure on ROA.
β_{05j} represents within group j, the influence of IV on ROA.

The combined level 2 model is $y_{tij} = b_{00j} + b_{01j}(industry) + b_{02j}(age) + b_{03j}(size) + b_{04j}(financialstructure) + b_{05j}(IV) + g_{0ij} + e_{tij}$

In the next step, we are interested in understanding the factors that explain $\beta_{00j}, \beta_{01j} \ldots \beta_{05j}$. If we assume that β_{00j} varies across groups, the grand mean of ROA is γ_{000}, and other variables $\beta_{01j} \ldots \beta_{05j}$ don't vary across groups, then it is a random intercept and a fixed slope model.

Random intercept and fixed slope model (RIFSM)

$$\beta_{00j} = \gamma_{000} + \mu_{00j}$$
$$\beta_{01j} = \gamma_{010}$$
$$\beta_{02j} = \gamma_{020}$$
$$\beta_{01j} = \gamma_{010}$$
$$\beta_{03j} = \gamma_{030}$$
$$\beta_{04j} = \gamma_{040}$$
$$\beta_{05j} = \gamma_{050}$$

So the combined random intercept and fixed slope model is
$g_{tij} = g_{000} + m_{00j} + g_{010}(industry) + g_{020}(age) + g_{030}(size) + g_{040}(financialstructure) + g_{040}(financialstructure) + g_{050}(IV) + g_{0ij} + e_{tij}$ where γ_{000} is the intercept and μ_{00j} is the error in equations at Level 3.

If we assume both β_{00j} and $\beta_{01j} \ldots \beta_{05j}$ vary across groups, then it is a random intercept and a random slope model (RIRSM). Based on Heck et al (2010), when dealing with such a complicated multilevel design, the use of SPSS Mixed is the most appropriate. Thus, we used the SPSS Linear Mixed Model (MIXED) to conduct our analysis.

The use of longitudinal data and SPSS MIXED provides three advantages over cross-sectional analyses. First, longitudinal data has more degrees of freedom and therefore, estimates are more efficient than in cross-sectional designs. Second, the SPSS MIXED allows for violations of sphericity in the error structure (Ployhart et al., 2002; Quene and Bergh, 2004). Violations of the sphericity assumption are very common in the repeated measures data. The traditional GLM procedure places rather severe restrictions on sphericity, since violations of sphericity will affect the interpretation of significance tests. Unlike GLM, the SPSS MIXED model does not require sphericity. Finally, the SPSS MIXED is able to represent the results in one model as opposed to multiple levels by incorporating random effects into the model.

We used the -2log likelihood ratio to compare the performance of the RIFSM and RIRSM models. We found the model with a random slope component tends to yield the lowest -2 log Likelihood ratio, indicating a better model fit. However, the results of all models yield consistent results when examining the relationships between independent variables and dependent variables. To simplify the models, we report the results of the random intercept and fixed slope model.

5. Findings

First, we combined horizontal *keiretsu* data and the vertical *keiretsu* data to examine the correlations between variables. Table 1 shows centrality is positively correlated with profitability and negatively correlated with profit stability. This provides initial support for our

hypotheses.

Table 1 About Here

5.1. Horizontal keiretsu central firms and vertical keiretsu central firms

Table 2 compares horizontal and vertical central firms on profitability and stability. For Models 1 through 4 the intra-class correlation coefficient (ICC) is reported. The ICC represents the amount of variance between *keiretsu* groups, calculated as follows: (intercept covariance parameter estimate)/(intercept covariance parameter estimate + residual covariance parameter estimate) (Bliese, 2000; Singer, 1998). These estimates indicate that firms within a *keiretsu*, in general, are not completely independent and as a result, an ordinary regression analysis may yield misleading results (greater ICC indicates greater dependence). ICC value above 0.10 indicates non-independence of a DV (Bliese and Ployhart, 2002). The models are arranged incrementally (as variables are added): the initial models (1 and 3) include only the control variables; the next models (2 and 4) add the horizontal central binary to test Hypotheses 1 and 2.

Model 1 presents the effect of control variables on profit stability for central horizontal and vertical *keiretsu* firms. Panel data includes 945 firm/year observations. The analysis focuses on central firms; the calculation of profit stability necessarily loses some firm/year observations compared to Model 3. Only the construction industry control variable is significant. In Model 2, the horizontal central *keiretsu* binary is added to examine central horizontal versus central vertical *keiretsu* profit stability. The ICC of 0.27 indicates the multilevel analysis is appropriate (Bliese and Ployhart, 2002). The AIC decrease from Model 1 to Model 2 indicates that the increase in explanatory power of the model due to the addition of the horizontal central *keirestu* binary is greater than the penalty assessed for the increase in the number of parameters

(Burnham and Anderson, 2004). The improved model fit, through the addition of the horizontal central *keiretsu* binary, is supported by the significance of the change in Chi^2 (Kumar and Sharma, 1999).

In Model 2 the coefficient for central horizontal *keiretsu* firms is negative and statistically significant (β = -2.68, $p < .001$). Thus, central horizontal *keiretsu* firms tend to have a lower standard deviation for ROA and are more stable than central vertical *keiretsu* firms. This result indicates that central horizontal *keiretsu* firms have more stable profits than central vertical *keiretsu* firms, supporting Hypothesis 1.

Model 3 presents the effect of control variables on profitability of central horizontal and vertical *keiretsu* firms. The panel data includes 1052 firm/year observations. The control variables for financial structure and the construction industry are both significant. In Model 4, the horizontal central *keiretsu* binary is added to examine differences in central horizontal versus central vertical *keiretsu* profitability. The ICC of 0.15 indicates the multilevel analysis is appropriate (Bliese and Ployhart, 2002). The AIC decline from Model 3 to Model 4 supports the importance of the added variable (Burnham and Anderson, 2004). Improved model fit, through the addition of the horizontal central *keiretsu* binary, is supported by the significance of the change in Chi^2 (Kumar and Sharma, 1999).

In Model 4 the coefficient for central horizontal *keiretsu* firms is negative and significant (β = -1.82, $p < .001$) indicating that central horizontal *keiretsu* firms tend to have lower average profitability than central vertical *keiretsu* firms. Axiomatically, central vertical *keiretsu* firms have greater profitability than central horizontal *keiretsu* firms, supporting Hypothesis 2.

Table 2 About Here

5.2. Central versus non-central keiretsu firms

Table 3 compares results for central and non-central horizontal and vertical *keiretsu* firms with respect to profit stability and profitability. Models 5 and 7 include control variables for profit stability and profitability, respectively. Models 6 and 8 add centrality in order to test Hypotheses 3 and 4. Model 9 re-examines central firms versus non-central firms for the vertical *keiretsu,* without the nested effects due to the low ICC of Model 8, explained below.

Model 5 presents the effect of control variables on profit stability for horizontal *keiretsu* firms. Panel data includes 1423 observations and focuses on horizontal firms. Control variables for the electronic equipment industry and financial structure are significant. Model 6 adds the horizontal central *keiretsu* binary comparing central *keiretsu* profit stability to non-central *keiretsu* profit stability. The ICC at 0.11 indicates that the multilevel analysis is appropriate (Bliese and Ployhart 2002). The AIC decline from Model 5 to Model 6 supports the importance of the added variable (Burnham and Anderson, 2004). Improved model fit, through the addition of the horizontal central *keiretsu* binary, is supported by the significance of the change in Chi^2 (Kumar and Sharma, 1999). Model 6 shows a negative and statistically significant (β = -0.41, $p <$ .05) coefficient for central horizontal *keiretsu* firms indicating that they typically have greater profit stability than non-central horizontal firms, supporting Hypothesis 3.

Model 7 presents the effect of the control variables on profitability of vertical *keiretsu* firms. The panel data includes 1509 observations. The electronic equipment industry and financial structure control variables are significant. In Model 8, the vertical central *keiretsu* binary is added to compare central *keiretsu* profitability against non central *keiretsu* profitability. The AIC decline from Model 5 to Model 6 supports the importance of the added variable

(Burnham and Anderson, 2004). Improved model fit, through the addition of the horizontal central *keiretsu* binary, is supported by the significance of the change in Chi^2 (Kumar and Sharma, 1999).

In Model 8, the coefficient for central vertical *keiretsu* is positive and significant ($\beta = 0.64$, $p < .001$) indicating that they are more profitable than non central vertical *keiretsu* firms, supporting Hypothesis 4. However, the ICC of Model 8 is 0.05 indicating the applicability of a non-nested model (Bliese and Ployhart, 2002). To address this, we estimated Model 9, dropping the nested effect of firms within *keiretsu* groups. The results of Model 9 are very similar to Model 8 with the coefficient for central vertical *keiretsu* significant ($\beta = 0.6$, $p < .001$). The results of Model 8 and Model 9 both find that central vertical *keiretsu* firms tend to be more profitable than non central vertical *keiretsu* firms, supporting Hypothesis 4.

Table 3 About Here

5.3 Post Hoc Analyses

We conducted *post hoc* sensitivity analyses to see if our results are consistent across different *keiretsu* groups. Overall the *post hoc* sensitivity analyses supported our general findings. Seven of the eight horizontal *keiretsu* groups showed that central horizontal *keiretsu* firms had greater profit stability than non-central horizontal *keiretsu* members. Twenty-four of 29 vertical groups showed that central vertical *keiretsu* firms were more profitable than non-central vertical *keiretsu* firms. One last *post hoc* analysis examined the stability of the central versus non-central firm effect across time. We split the sample into two periods 1999-2003 and 2003-2007 and conducted profitability and stability analysis. Across both periods, vertical

keiretsu central firms remain significantly advantaged compared to non-central member firms but central horizontal *keiretsu* firms were significantly advantaged only in the 1999-2003 period.

We speculated that the lack of significance of the centrality variable for the horizontal *keiretsu* in 2003-2007 may be attributed to two differing proximate reasons, the changing nature of the horizontal *keiretsu* due to economic and political pressures and/or a difference in the level of economic volatility between the periods. During 2003-2007, where we did not find statistical significance, a great deal of change was occurring in the horizontal *keiretsu.* Mergers of central *keiretsu* banks disrupted the one-set principal, reducing the number of horizontal *keiretsu*. 'Trust banks' becoming among the biggest shareholders of large Japanese firms (Schaede, 2006) also has an uncertain effect on the actions of the affected horizontal *keiretsu* member firms. None of these changes mean that the power dependence relationships have disappeared, but relationships are changing and in need of further study.

Second, differences in overall levels of economic volatility may affect our stability measure; the use of power dependency by the central firm to stabilize profits may be easier to detect in volatile times because they create a larger difference in ROA stability between the central firm and non-central firms than in times of greater overall economic stability. For this reason, studying the effect of central firm stability compared to non-central firm stability is better done over a longer period in order to more easily view central firm stability against the backdrop of greater volatility in GDP economic cycles.

6. Conclusion

This study is an initial attempt to predict and explain relative central firm performance and stability for both *horizontal* and *vertical keiretsu*. Using a historical perspective we

hypothesized and found that: (1) central vertical *keiretsu* firms are more profitable than central horizontal *keiretsu* firms; and (2) central horizontal *keiretsu* firms have greater profit stability than central vertical *keiretsu* firms. Using a power-dependence perspective we hypothesized and found that: (1) central vertical *keiretsu* firms are more profitable than non central vertical *keiretsu* firms; and (2) central horizontal *keiretsu* firms have greater profit stability than non central horizontal *keiretsu* firms.

Evidence supports the notion that central firms perform better than member firms for both types of *keiretsu,* (in 1999-2003 for horizontal *keiretsu* and for both 1999-2003 and 2003-2007 for vertical *keiretsu*). In vertical *keiretsu*, the central manufacturer is always the largest and most resource abundant firm. Hence, although the empirical analysis supports our power dependency predictions, there is no way in vertical *keiretsu*, using our data, to separate the lead manufacturer's central position from its resource abundance and therefore no way provide a critical test to differentiate between two competing explanations (power dependency versus resource superiority). This represents a limitation of our study. Future efforts using primary data may be able to separate out the effects of superior resources versus power dependency to determine which influences lead manufacturer vertical *keiretsu* performance.

Based on our empirical results, we draw three conclusions. First, it appears that *keiretsu* central firms use power to become the primary beneficiary of a *keiretsu*. Second, systematic performance differences exist between *horizontal* and *vertical keiretsu* central firms; central vertical *keiretsu* firms have greater profitability while central horizontal *keiretsu* firms have greater profit stability. Third, benefits central *keiretsu* firms derive from the group structures is obtained from reduced profits/profit stability of non-central *keiretsu* firms.

We also draw managerial implications. While both vertical and horizontal central *keiretsu* firms are interested in profits, there are differences in the strategies they pursue. In vertical *keiretsu*, central manufacturers shift costs to non-central member firms. Resulting cost savings commonly create price-based advantages for them compared to typical multinational enterprises. In horizontal *keiretsu*, central firms influence non-central member firms to minimize risk. Foreign competitors need to understand what type of *keiretsu* firm they are dealing with in order to develop effective counter-strategies.

6.1. Limitations and future research

This study has several limitations. First, our sample only included publicly traded companies. Future research may wish to extend our research questions by examining private *keiretsu* firms. Second, we used simple constructs to measure profits and profit stability (*ROA* and standard deviations of *ROA*). Future research may wish to use other measures of firm performance including: sales, sales growth, Tobin's Q and/or debt. Third, our measure of group affiliation is from 1996/1997 as more recent IGJ listings are unavailable. This represents a significant limitation for our study as horizontal *Keiretsu* structures are changing. How these changes affect historical relationships is, at this point, unclear and needs further study.

Finally, our paper raises additional research questions. For instance, given that the primary beneficiaries of *keiretsu* structures are the central firms, why do members firms continue to stay? In the early development of the *keiretsu* institutional voids set the conditions for joining a business group (Carney, 2008). But as Japan developed modern institutional structures, the *keiretsu* form of governance continued to persist.

We point to three possible reasons. First, tradition reflected in the institutional norms of

conformity and legitimacy may account for some of this. Thus, future scholars may wish to apply institutional theory in their attempts to answer this question. The *keiretsu* have been remarkably resistant to change (McGuire and Dow, 2003) and some member firms may stay due to institutional advantages like legitimacy or for simply historical reasons.

Second, a power dependency perspective may explain why member firms remain. Even as institutional environments in which business groups operate mature, central firms in positions of power are unlikely to voluntarily relinquish their power advantages (McGuire and Dow 2009). It may be that many firms remain because of power dependency relationships that persist between central and member firms.

Finally, *keiretsu* membership may provide some spillover benefits. Lincoln, et al. (1996) found less variability in the performance of horizontal *keiretsu* firms compared to independent firms. McGuire and Dow (2003) found that horizontal *keiretsu* firm performance remained stable even after major economic and regulatory changes took place in Japan in the early 1990s. Will recent changes to some of the horizontal *keiretsu* change that?

Thus, our paper is research opening, raising as many questions as it answers. For instance, do our findings hold over long periods of time or do "boom and bust" cycles moderate these relationships? Do our findings generalize to business groups in other countries? Do central firms exist in other nations' business groups? If so, do these central firms play a similar or different role in their respective groups? Are they the primary beneficiaries in these business groups? Do recent changes in two of the horizontal *keiretsu* affect member/central firm relationships? How? Future efforts, by addressing these and other questions, will be able to better explain the role of the central firm in the *keiretsu* and provide better guidance to managers who attempt to compete with *keiretsu* firms in the world marketplace.

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Table 1
Correlation Matrix

Correlation Matrix

Variables	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
1 Profitability	-									
2 Stability	-0.24 **	-								
3 Centrality	0.02	-0.20 **	-							
4 Horizontal Central Firms	0.01	-0.01	-0.02	-						
5 Vertical Central Firms	-0.02	0.03	-0.10 **	-0.19 **	-					
6 Age	-0.03	0.05 *	0.07 **	-0.05 **	0.02	-				
7 Financial Structure	-0.11 **	0.02	0.01	0.01	0.03	0.00	-			
8 Firm Size	0.03	0.06 **	0.30 **	-0.03	-0.07 **	0.06 **	0.00	-		
9 Chemical	0.04 *	-0.17 **	0.05 **	0.00	-0.03	0.17 **	-0.02	-0.08 **	-	
10 Machines	0.02	-0.02	0.04 *	-0.04 *	-0.07 **	-0.08 **	-0.01	0.16 **	-0.11 **	-
11 Construction	-0.14 **	0.00	0.00	0.01	0.06 **	-0.03	0.03	-0.09 **	-0.10 **	-0.10 **
12 Electronic Equipment	-0.05 **	0.15 **	-0.07 **	-0.06 **	-0.04 *	0.03	-0.01	0.06 **	-0.12 **	-0.12 **
13 Mining	-0.03	0.02	0.01	0.01	0.16	-0.02	0.00	-0.03	-0.03	-0.03
14 Rubber	0.02	-0.06 **	0.04 *	-0.01	-0.05 **	0.09 **	-0.01	0.00	-0.05 **	-0.05 **
15 Transportation	0.01	-0.05 **	0.09 **	-0.01	0.01	0.07 **	0.00	-0.03	-0.08 **	-0.08 **
16 Automobile	0.06 **	0.11 **	-0.14 **	0.08 **	0.03	-0.03	-0.02	0.11 **	-0.12 **	-0.12 **

Correlation Matrix

Variables	*11*	*12*	*13*	*14*	*15*
11 Construction	-				
12 Electronic Equipment	-0.11 **	-			
13 Mining	-0.03	-0.03	-		
14 Rubber	-0.05 **	-0.06 **	-0.01	-	
15 Transportation	-0.08 **	-0.10 **	-0.02	0.02	-
16 Automobile	-0.11 **	-0.13 **	-0.03	-0.01	-0.06 **

†$p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$.

Table 2
Horizontal *keiretsu* central firms and vertical *keiretsu* central firms

Variables	Stability		Profitability	
	Model 1	Model 2	Model 3	Model 4
Intercept	5.52 *	3.9 †	2.21	2.11
Age	0.08	-0.07	-0.09	-0.06
Firm Size	-0.04	-0.06	0.29	-0.02
Financial Structure	-0.08	-0.11	-4.44 ***	-4.79 ***
Chemical	-0.67	-0.51	0.29	0.37
Machines	-0.06	<0.01	-1.06 †	-0.99 †
Construction	1.09 **	1.19 ***	-2.47 ***	-2.21 ***
Electronic Equipment	0.36	0.28	-0.23	-0.36
Mining	0.92	0.82	1.97	2.10
Rubber	-0.71	-0.62	-0.24	-0.16
Transportation	-0.05	0.02	0.30	0.26
Automobile	0.38	0.46	-0.93	-0.75
Horizontal Central Firms		-2.68 ***		-1.82 ***
-2Log-likelihood	8092.48	8061.22	5580.19	5569.76
Akaike's Info Criterion (AIC)	8122.48	8093.22	5610.19	5601.76
$\triangle X^2$		31.26 ***		10.43 ***
N (Observations)	945	945	1052	1052
ICC	0.27	0.27	0.20	0.15

†p< .10; * p< .05; ** p< .01; *** p< .001. Two-tailed test

Table 3
Central *keiretsu* firms compared to non central *keiretsu* firms

Variables	Horizontal Keiretsu Stability		Vertical Keiretsu Profitability		
	Model 5	Model 6	Model 7	Model 8	Model 9
Intercept	1.78	2.72	-1.09	-2.69	-2.82
Age	<0.01	0.01	0.05	0.06	0.09
Firm Size	0.06	0.14	0.3 †	-0.02	-0.02
Financial Structure	-0.70 **	-0.64 **	-4.71 ***	-4.81 ***	-4.75 ***
Chemical	-0.65	-0.66	-1.15	-1.27	-1.38
Machines	-0.26	-0.32	0.20	0.32	0.31
Construction	0.27	0.18	-0.89	-0.83	-0.90
Electronic Equipment	1.71 ***	1.58 ***	-1.19 **	-1.05 *	-1.14 **
Mining	0.20	0.21	-1.99	-2.02	-1.87
Rubber	-0.54	-0.66	-0.08	-0.24	-0.41
Transportation	-0.56	-0.54	0.50	0.38	0.34
Automobile	0.34	0.15	0.64	0.81 †	0.91 *
Centrality		-0.41 *		0.64 ***	0.60 ***
-2Log-likelihood	6354.55	6348.88	8196.00	8183.52	8185.06
Akaike's Information Criterion (AIC)	6386.55	6382.88	8226.00	8215.52	8215.06
$\triangle X^2$		5.67 *		12.48 ***	10.94 ***
N (Oberservations)	1423	1423	1509	1509	1509
ICC	0.07	0.11	0.05	0.05	

†p< .10; * p< .05; ** p< .01; *** p< .001. Two-tailed test